Peak Oil Special Order to the U.S. House of Representatives

5:30 pm – 6:30 pm

April 10, 2008

Congressman Roscoe Bartlett

www.bartlett.house.gov/EnergyUpdates


JUST WHY IS GAS SO EXPENSIVE?
SUPPLY
DEMAND

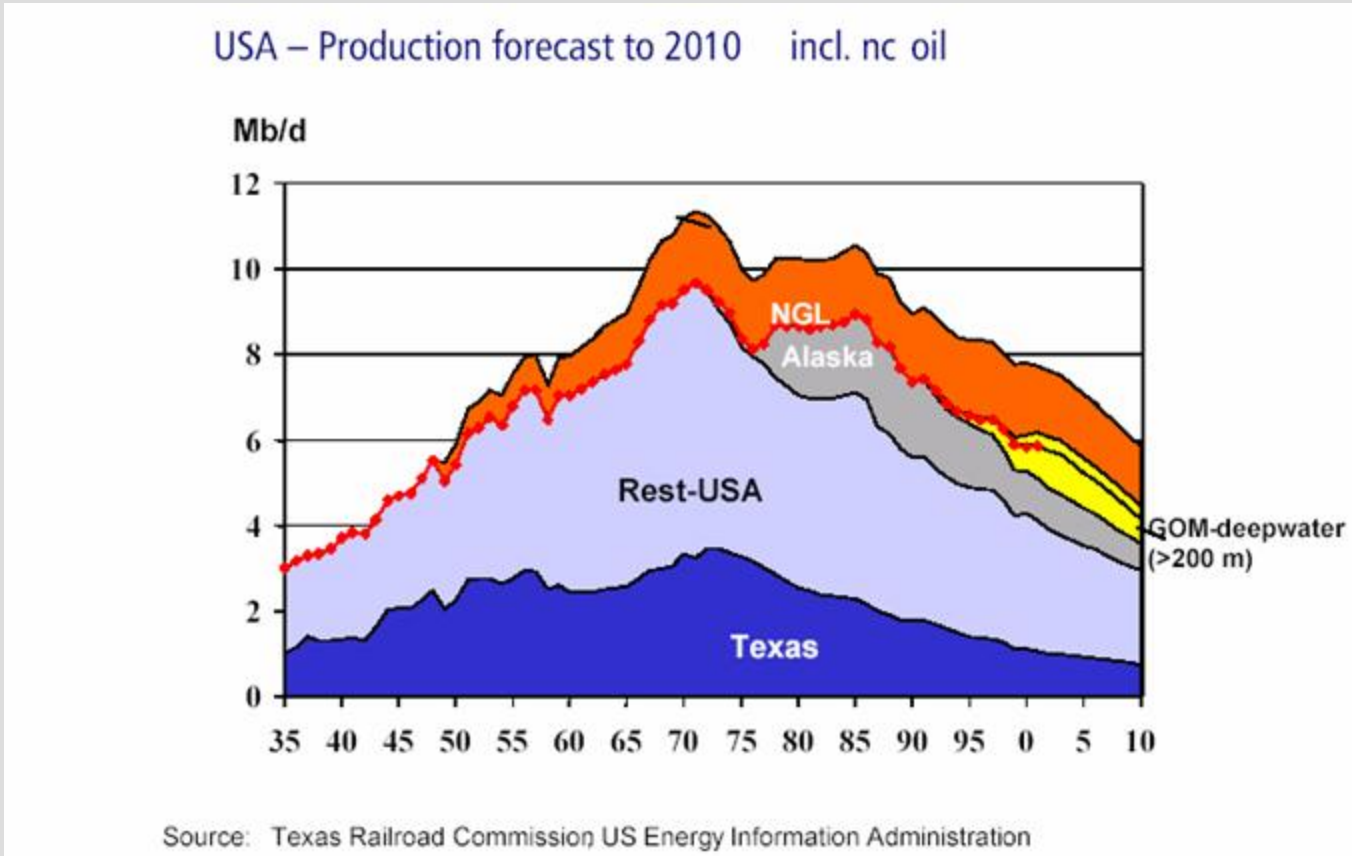
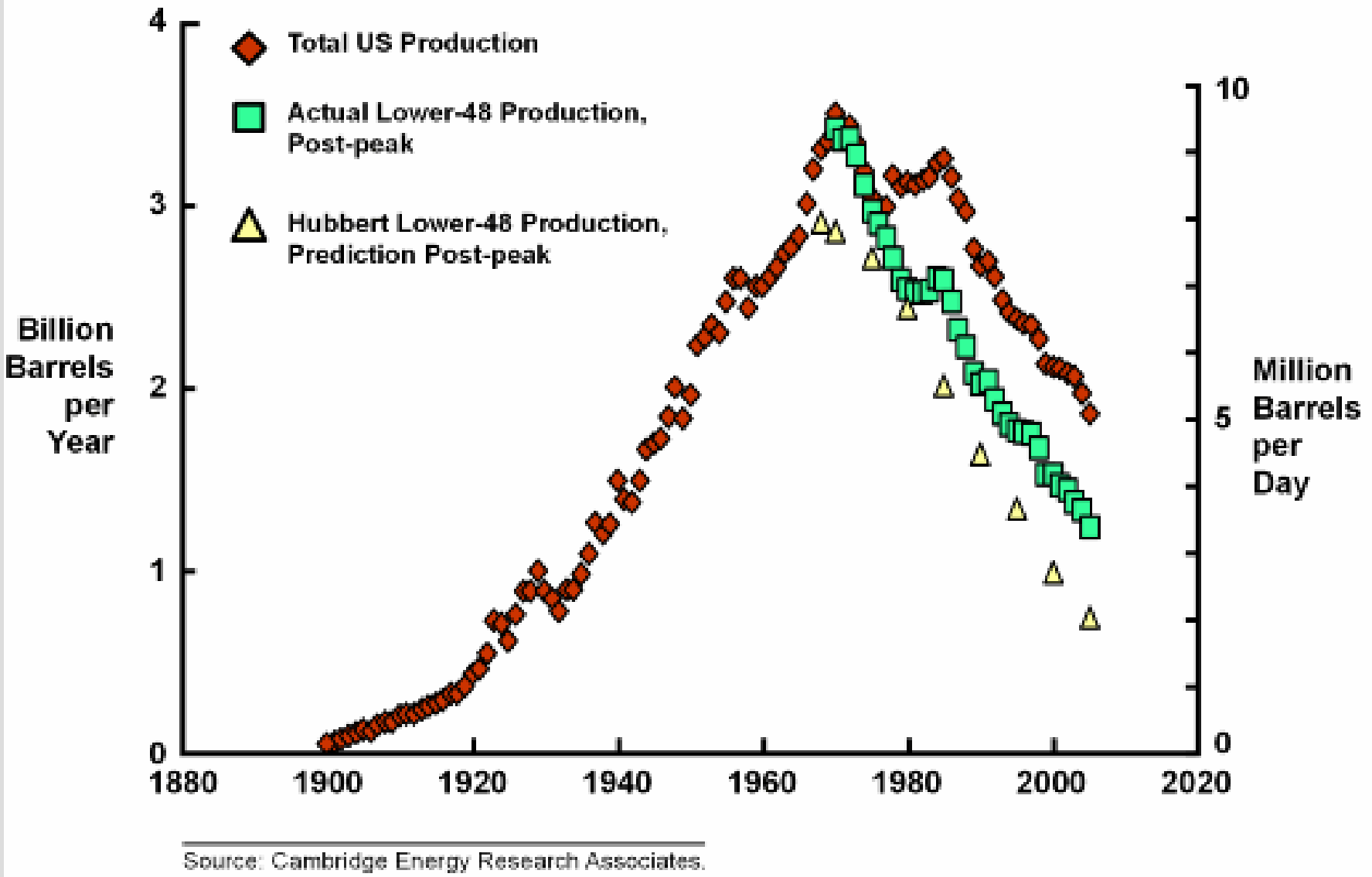
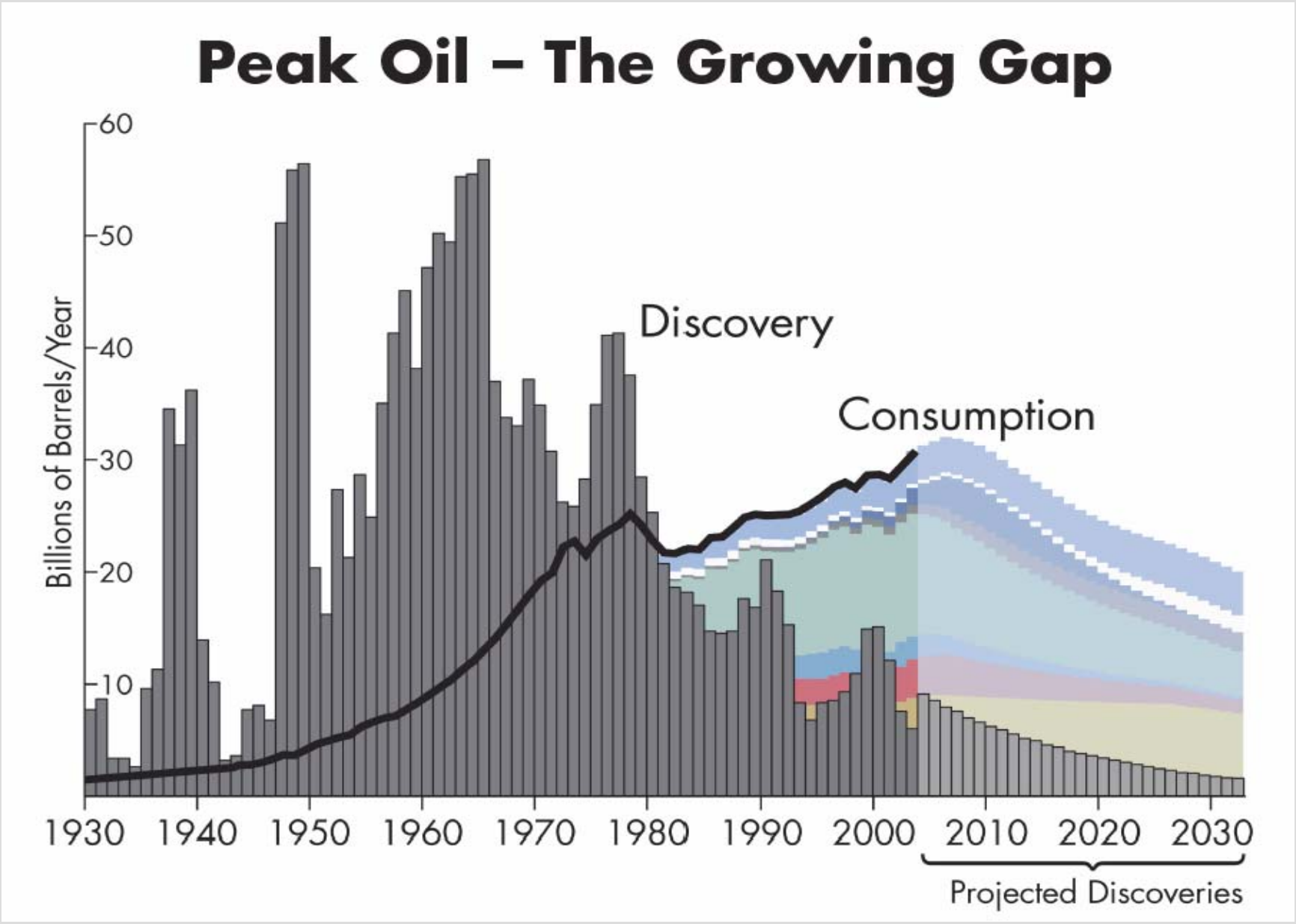


Figure 4: The future oil production profile for the declining oil regions of Texas and Rest of the USA is controlled simply by the physics of depletion, allowing a straightforward extrapolation of existing trends.

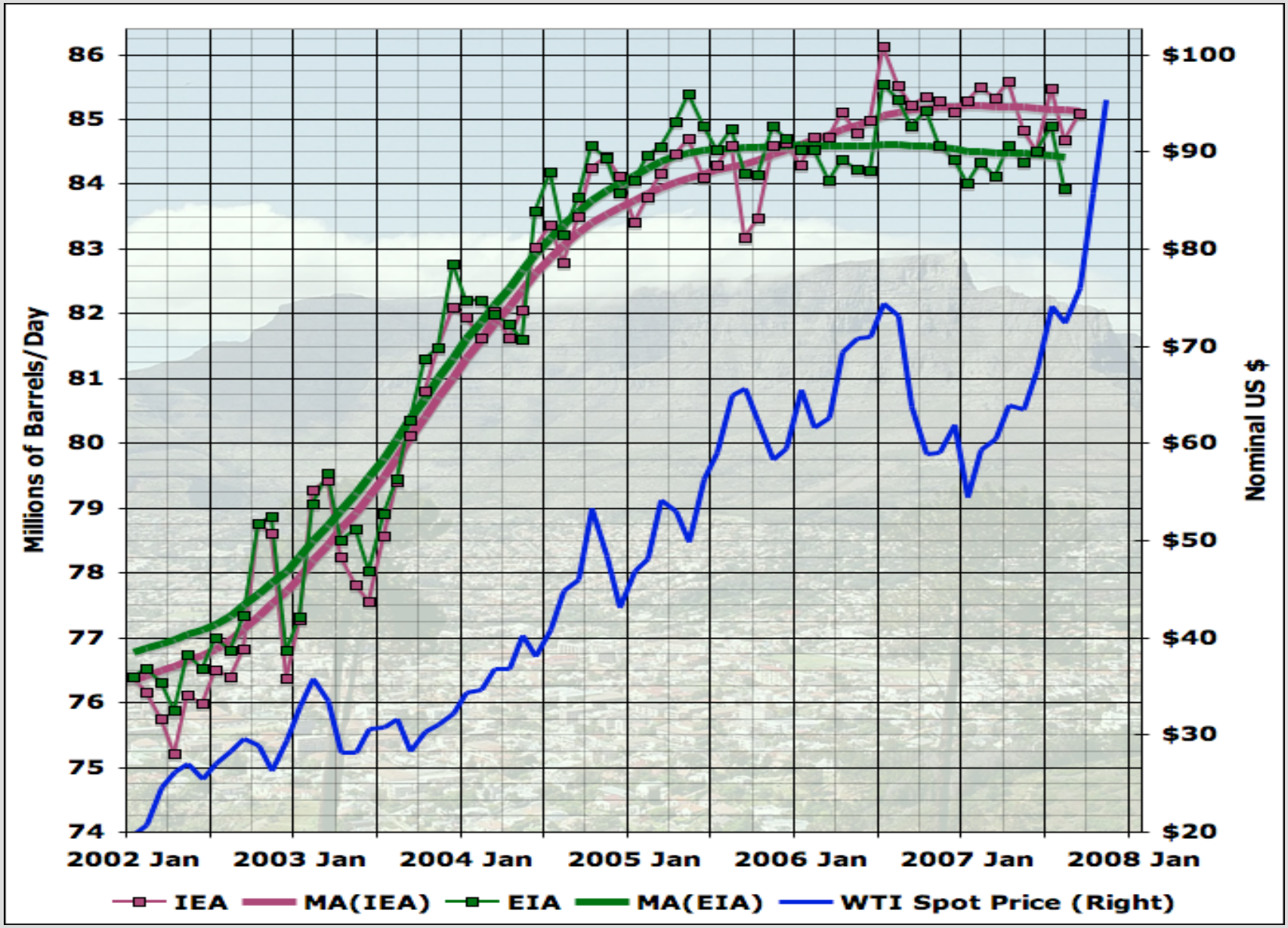
United States Production, Hubbert versus Actual



Source: Cambridge Energy Research Associates.

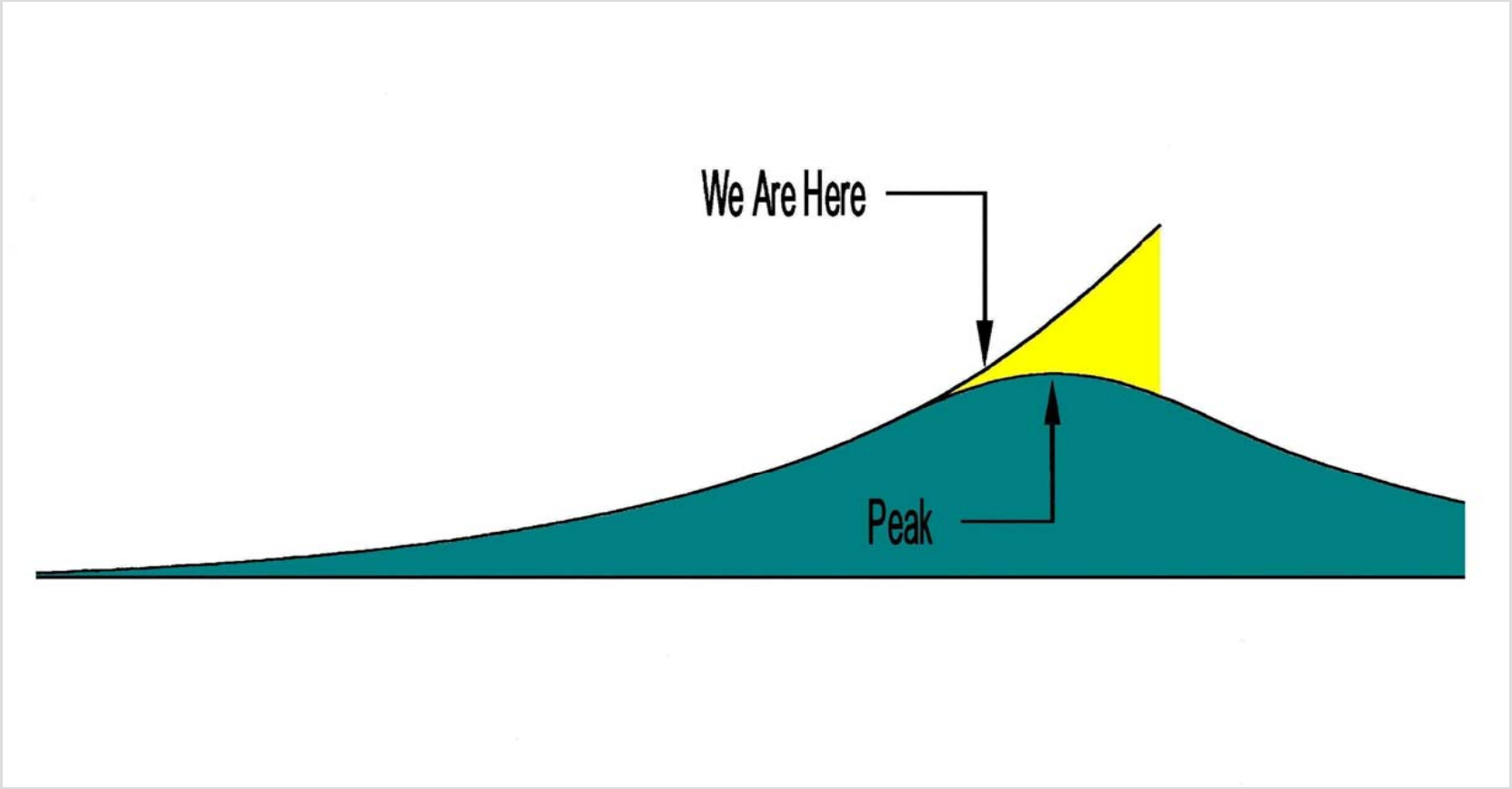

Peak Oil – The Growing Gap
Billions of Barrels/Year
60
50
40
30
20
10
Discovery
Consumption
1930
1940
1950
1960
1970
1980
1990
2000
2010
2020
2030
Projected Discoveries

Peak Oil – Are we there yet?



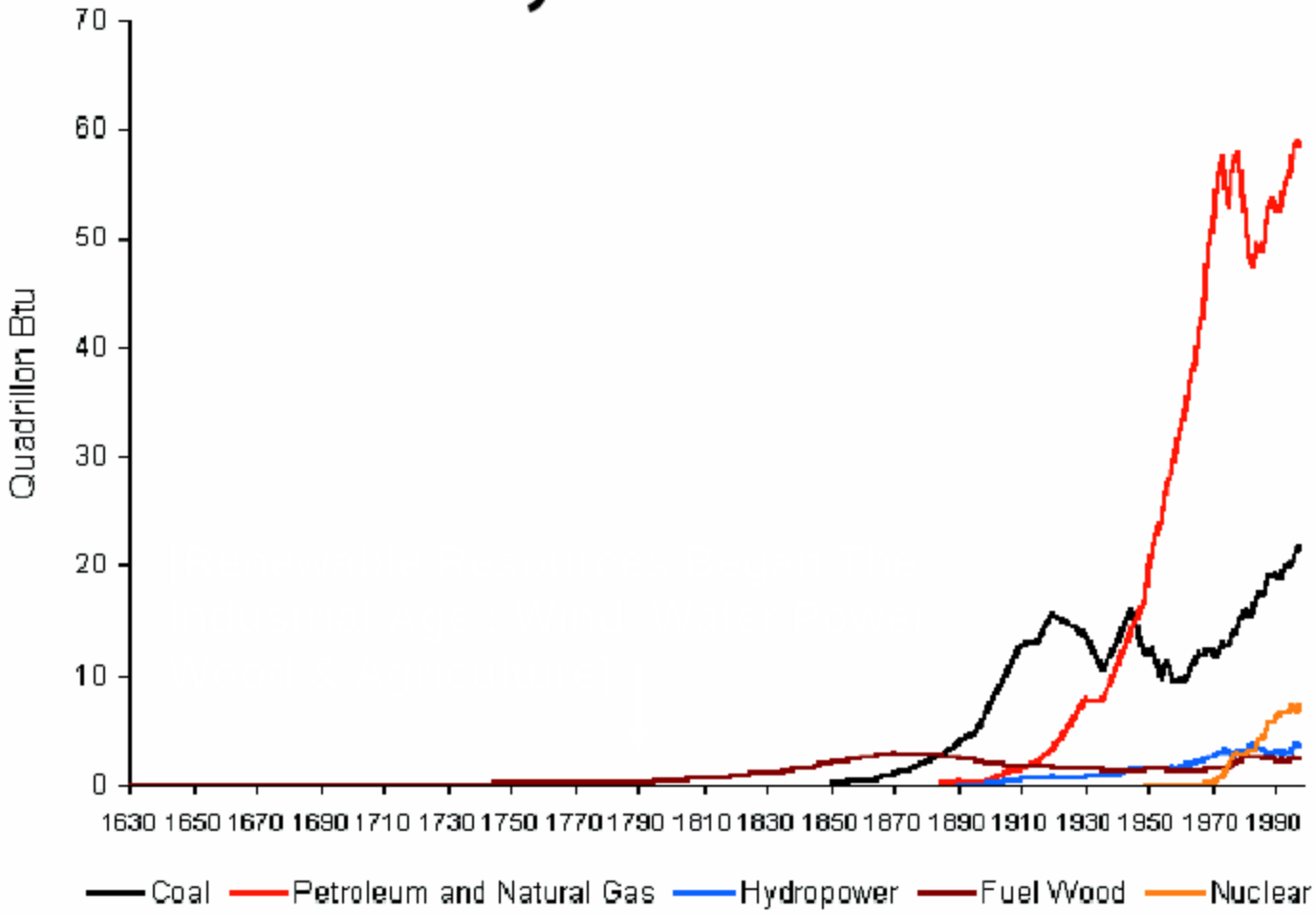
The Essence of the Problem

There is ***NO*** Ready Liquid Fuel Substitute!



- In the 8,000 years from the beginning of history to the year 2000 A.D. world population will have grown from 10 million to 4 billion, with 90% of that growth taking place during the last 5% of that period, in 400 years. It took the first 3,000 years of recorded history to accomplish the first doubling of population, 100 years for the last doubling, but the next doubling will require only 50 years.
- "Energy resources and our future" - by Admiral Hyman Rickover, 1957

US Consumption of Energy By Resource



- With high energy consumption goes a high standard of living. Thus the enormous fossil energy which we in this country control feeds machines which make each of us master of an army of mechanical slaves.
- Man's muscle power is rated at 35 watts continuously, or one-twentieth horsepower.
- Machines therefore furnish every American industrial worker with energy equivalent to that of 244 men.
- 2,000 men push his automobile along the road.
- His family is supplied with 33 faithful household helpers.
- Each locomotive engineer controls energy equivalent to that of 100,000 men;
- Each jet pilot controls energy equivalent to that of 700,000 men.
- "Energy Resources and Our Future," Admiral Hyman Rickover May 14, 1957

- Whether this Golden Age will continue depends entirely upon our ability to keep energy supplies in balance with the needs of our growing population.
- …Possession of surplus energy is, of course, a requisite for any kind of civilization, for if man possesses merely the energy of his own muscles, he must expend all his strength - mental and physical - to obtain the bare necessities of life.
- …A reduction of per capita energy consumption has always in the past led to a decline in civilization and a reversion to a more primitive way of life.
- Examples: Mayan, India, China, Middle East
- **"Energy Resources and Our Future, "Admiral Hyman Rickover May 14, 1957**

- **…there is nothing man can do to rebuild exhausted fossil fuel reserves.** They were created by solar energy 500 million years ago and took eons to grow to their present volume.

  In the face of the basic fact that fossil fuel reserves are finite, **the exact length of time these reserves will last is important in only one respect: the longer they last, the more time do we have, to invent ways of living off renewable or substitute energy sources and to adjust our economy to the vast changes which we can expect from such a shift.**

  Fossil fuels resemble capital in the bank. A prudent and responsible parent will use his capital sparingly in order to pass on to his children as much as possible of his inheritance. A selfish and irresponsible parent will squander it in riotous living and care not one whit how his offspring will fare.

- "Energy resources and our future" - Admiral Hyman Rickover, 1957

- I suggest that this is a good time to think soberly about our responsibilities to our descendents - *those who will ring out the Fossil Fuel Age.* We might…give a break to these youngsters by cutting fuel and metal consumption…so as to provide a safer margin for the necessary adjustments which eventually must be made in a world without fossil fuels.

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- "High-energy consumption has always been a prerequisite of political power. The tendency is for political power to be concentrated in an ever-smaller number of countries. Ultimately, the nation which control - the largest energy resources will become dominant. If we give thought to the problem of energy resources, if we act wisely and in time to conserve what we have and prepare well for necessary future changes, we shall insure this dominant position for our own country.

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Five Federal Government Peak Oil Reports

- **DOE Report #1 "Hirsch,"** February 2005
- **U.S. Army Corps of Engineers,** September 2005
- **DOE Report #2,** July 8, 2006
- **Government Accountability Office (GAO),** March 29, 2007
- **National Petroleum Council,** Fall, 2007

Global Peak Oil will happen

- World production of conventional oil will reach a maximum and decline thereafter. That maximum is called the peak.
- **Oil Peaking Presents a Unique Challenge. The world has *never* faced a problem like this.**

Hirsch Report #1: “Peaking of World Oil Production: Impacts Mitigation, and Risk Management,” Department of Energy, February 2005

Global peak presents "*an unprecedented risk management problem.*"

- **without timely mitigation, the economic, social, and political costs will be unprecedented.**
- ***Viable mitigation options exist*** on both the supply and demand sides, ***but*** to have substantial impact, ***they must be initiated more than a decade in advance of peaking.***

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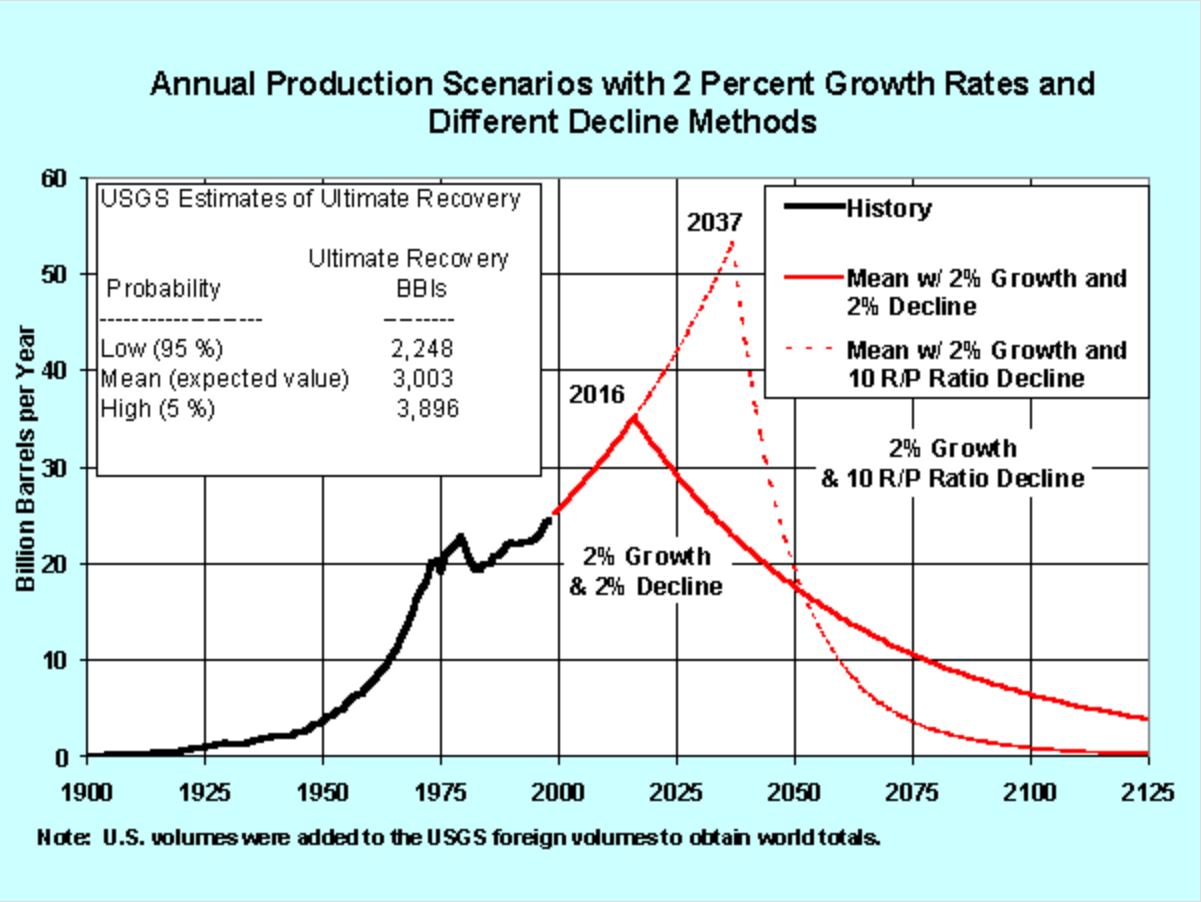
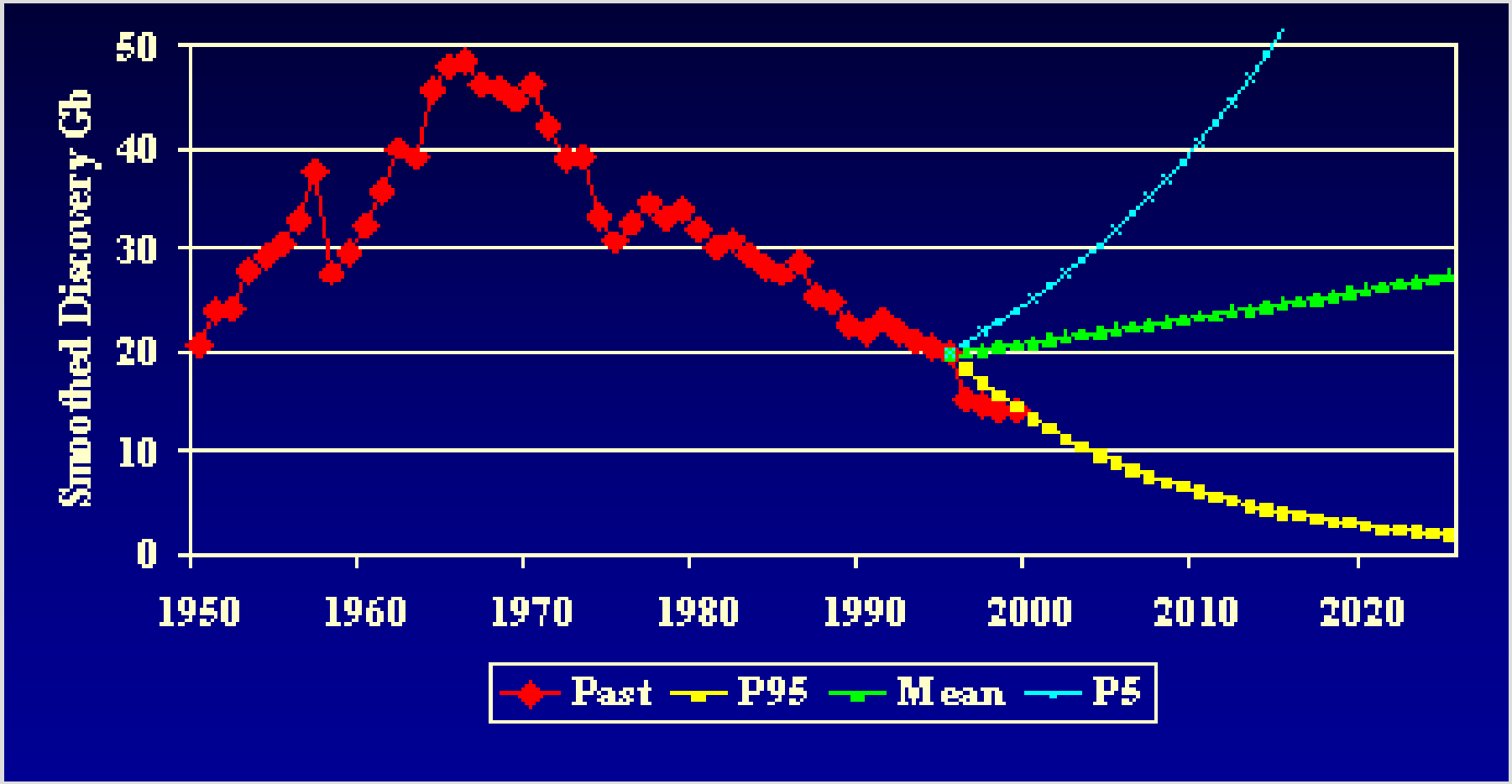


Two EIA oil production scenarios of the *probability* of USGS Estimates of ultimate world-recoverable oil *based on a mean (expected value)* of 3,003 billion barrels and a 2 percent annual world oil demand escalation. Hirsch Report #1: "Peaking of World Oil Production: Impacts Mitigation, and Risk Management," Department of Energy, February 2005

EIA Projections of Discovery



The USGS Estimate is "Utterly Implausible"

"Jean Laherrere made an assessment of the USGS report and concludes that:

The USGS estimate implies a five-fold increase in discovery rate and reserve addition, for which no evidence is presented. Such an improvement in performance is in fact utterly implausible, given the great technological achievements of the industry over the past twenty years, the worldwide search, and the deliberate effort to find the largest remaining prospects."

"Energy Trends and Their Implications for U.S. Army Installations," U.S. Army Corps of Engineers, September 2005

Oil is the most important form of energy in the world today.

- **Historically, no other energy source equals oil's intrinsic qualities of extractability, transportability, versatility, and cost.**
- The qualities that enabled oil to take over from coal as the front-line energy source for the industrialized world in the middle of the 20th century are as relevant today as they were then."

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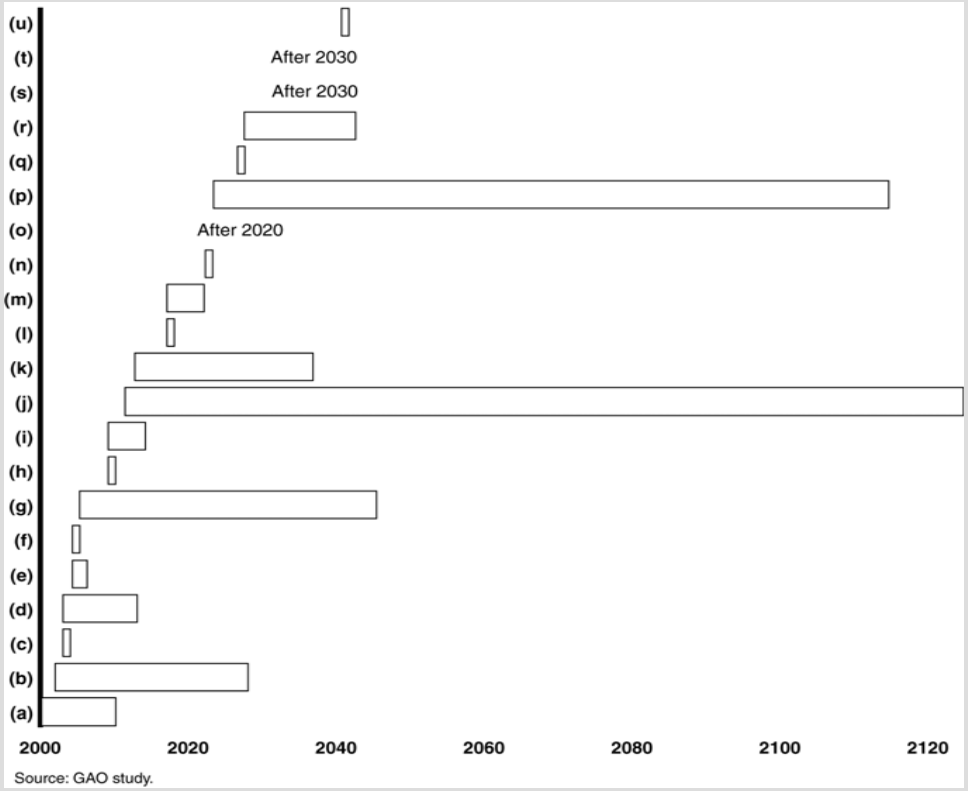
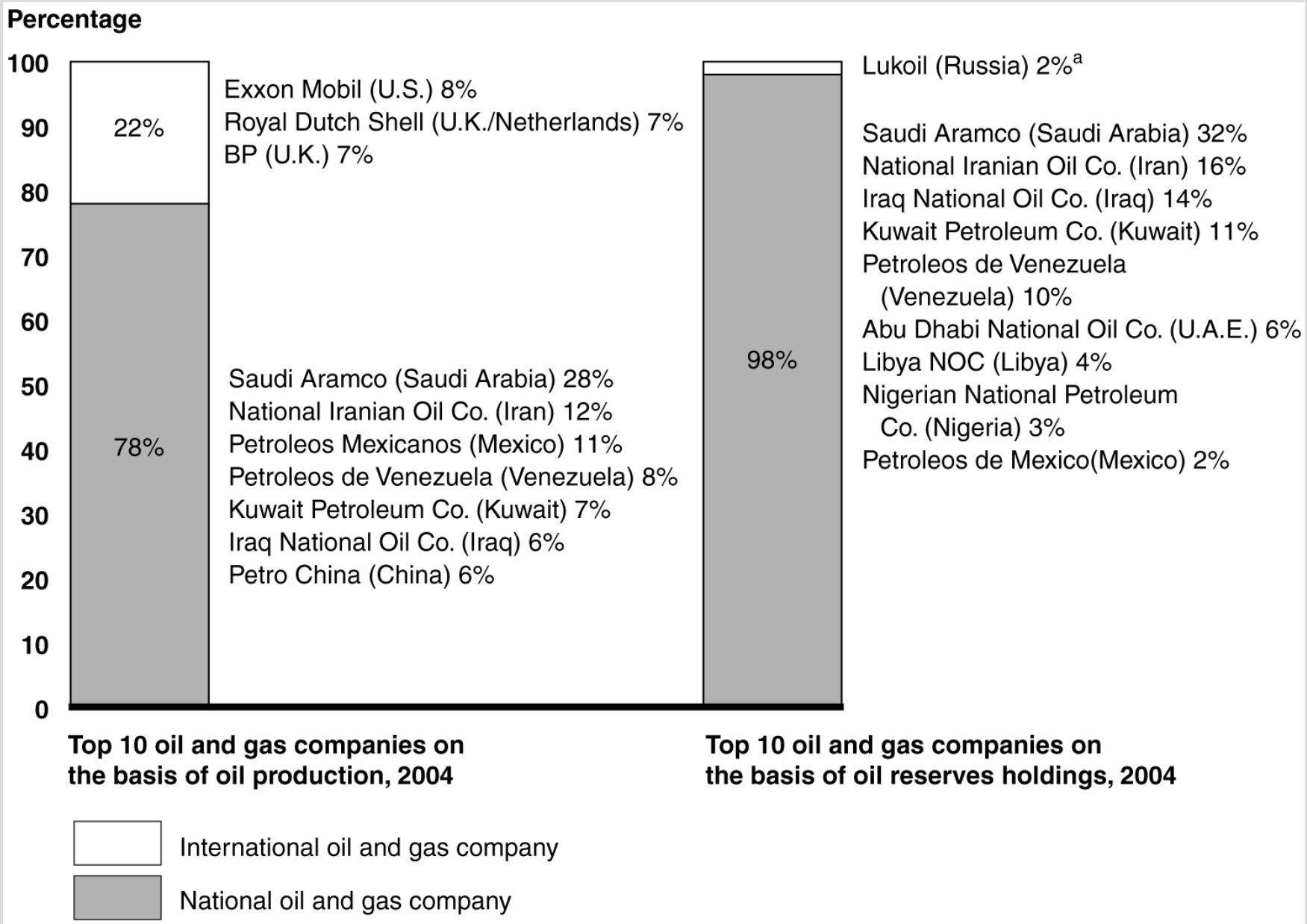
Key Estimates of the Timing of Peak Oil from the GAO Report





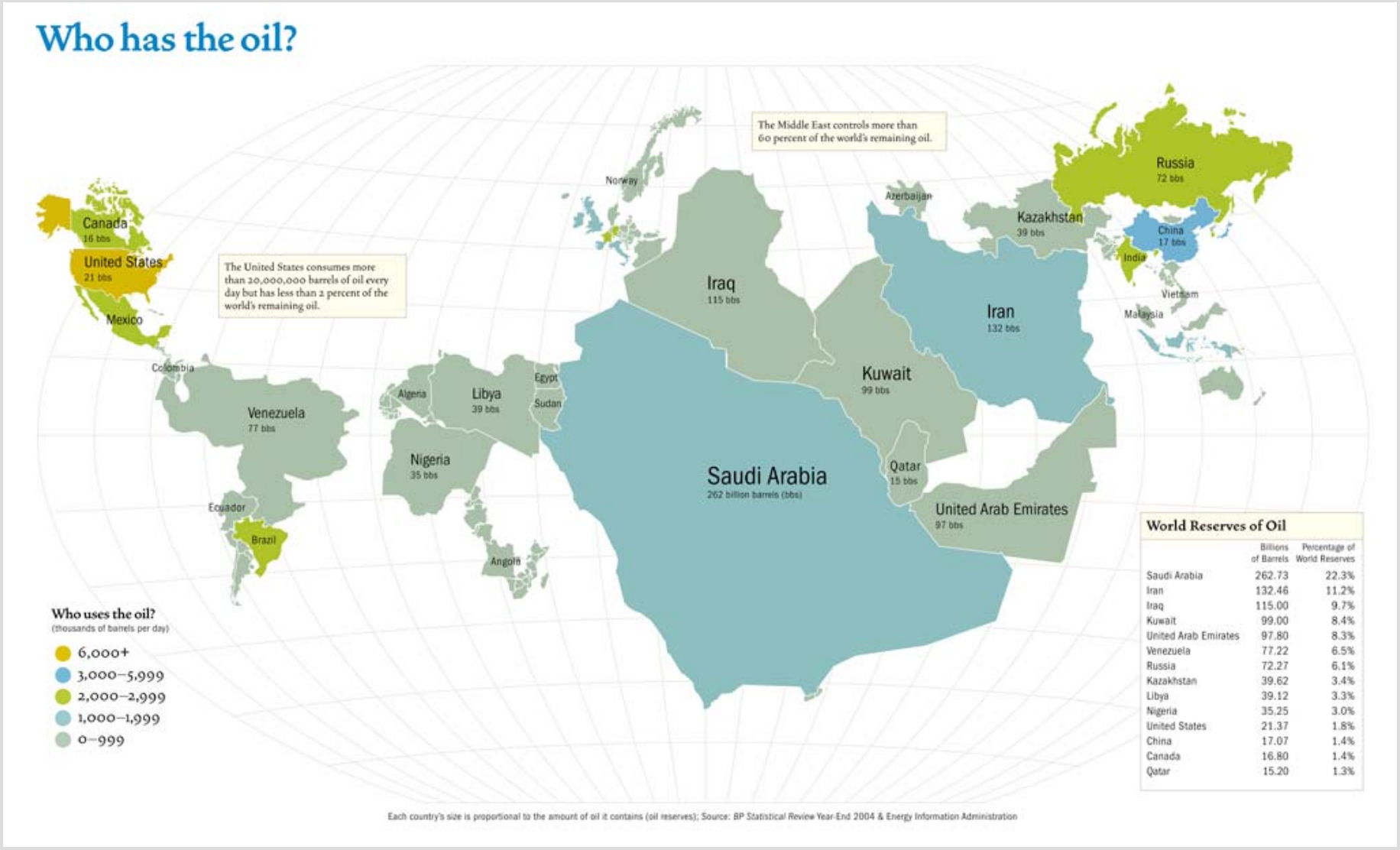
Source: GAO analysis of data from *Petroleum Intelligence Weekly* (Dec. 12, 2005).

The era of cheap energy is *gone*.

- **the United States, as the largest consumer of oil and one of the nations most heavily dependent on oil for transportation, may be especially vulnerable among the industrialized nations of the world.**
- Being at the mercy of world events will be an unsettling time for our consumers.

"CRUDE OIL - Uncertainty about Future Oil Supply Makes It Important to Develop a Strategy for Addressing a Peak and Decline in Oil Production" (GAO-07-283), **Government Accounting Office,** March 29, 2007

The World According to Oil



The United States and Oil

- **2%** of World Reserves
- **8%** of World Oil Production
- **5%** of World's Population
- U.S. Consumes **25%** of World's Oil Production
- More than **60% imported**
- **70% of oil is used for transportation**
- **U.S. transportation is dependent upon oil for 98 percent of its energy – *a proportion virtually unchanged since 1974.***

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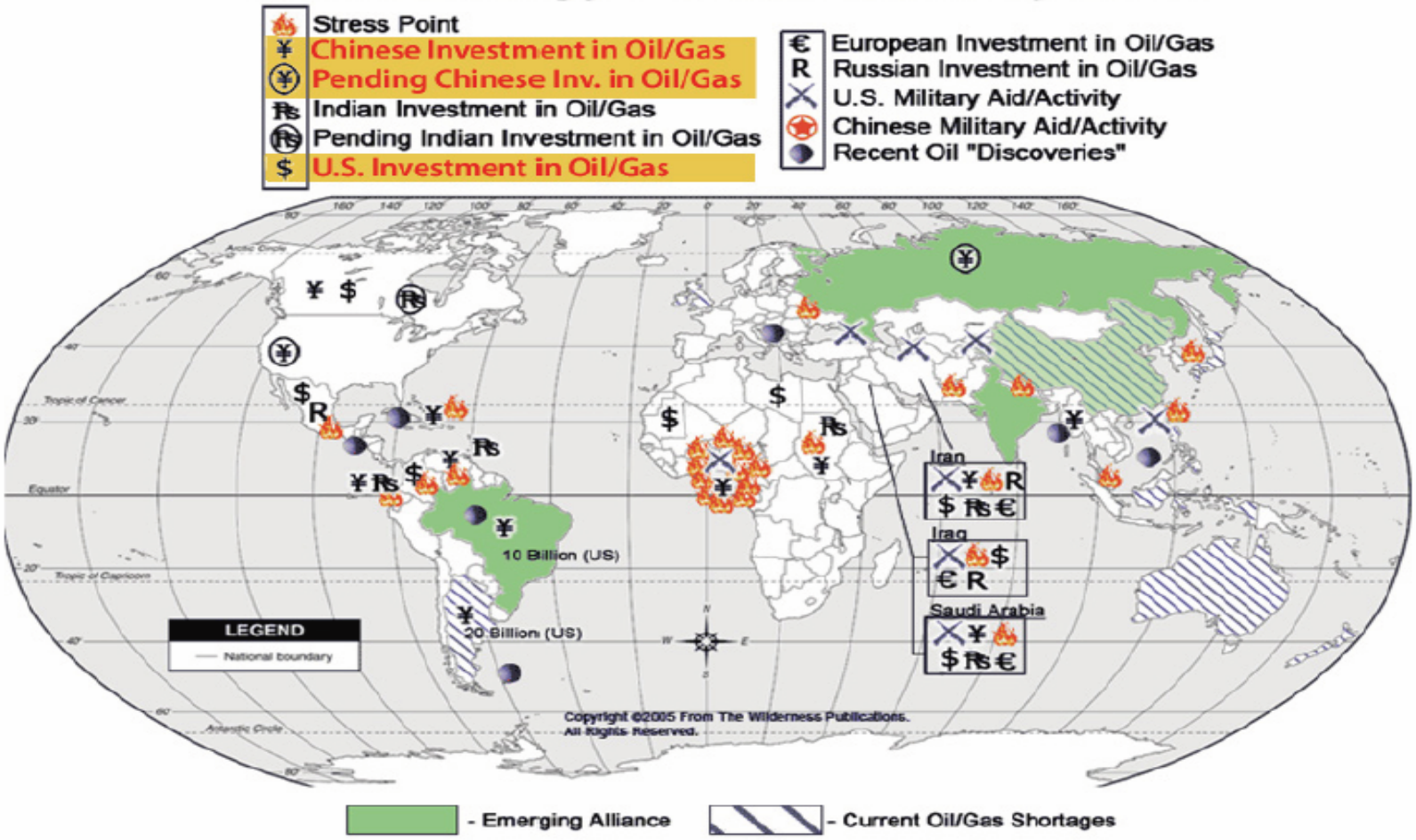
Peak Oil

World Energy Picture January 2005



China's "Post-Oil" Strategy

- Conservation
- Domestic Sources of Energy
- Diversify Sources of Energy
- Environmental Impact
- International Cooperation

(or confrontation)

We do have to do *something* about the energy problem. I can tell you that nothing has really taken me aback more as secretary of State than the way that the politics of energy is -- I will use the word warping diplomacy around the world.

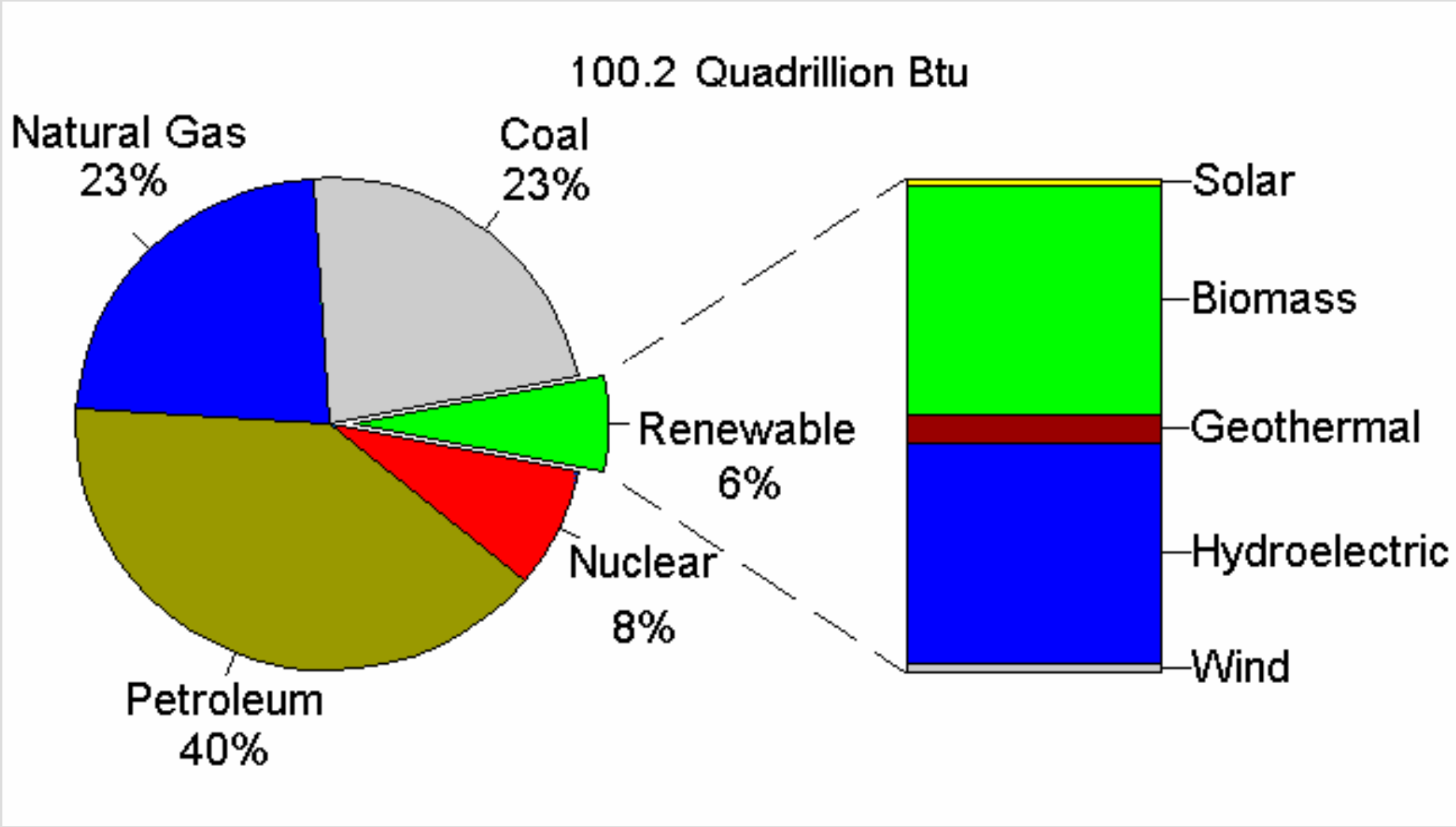
United States Secretary of State Condoleezza Rice before the Senate Foreign Relations Committee on April 5, 2006

Shell Oil CEO Jeroen van der Veer on Jan. 22, 2008

"By the year 2100, the world's energy system will be radically different from today's… the world's current predicament limits our maneuvering room. We are experiencing a step-change in the growth rate of energy demand…and Shell estimates that after 2015 supplies of easy-to-access oil and gas will no longer keep up with demand. ***As a result, society has no choice but to add other sources of energy."***

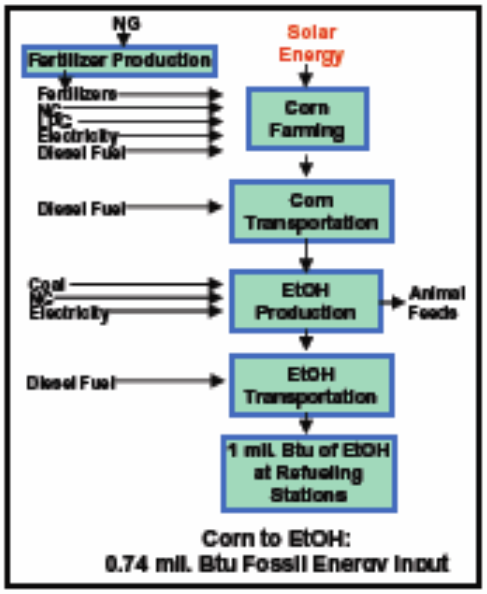
January 22, 2008 "Shell Energy Scenarios" letter/column by Jeroen van der Veer, Chief Executive, Shell Oil at http://www.shell.com/home/content/aboutshell-en/our_strategy/shell_global_scenarios/two_energy_futures/two_energy_futures_25012008.html

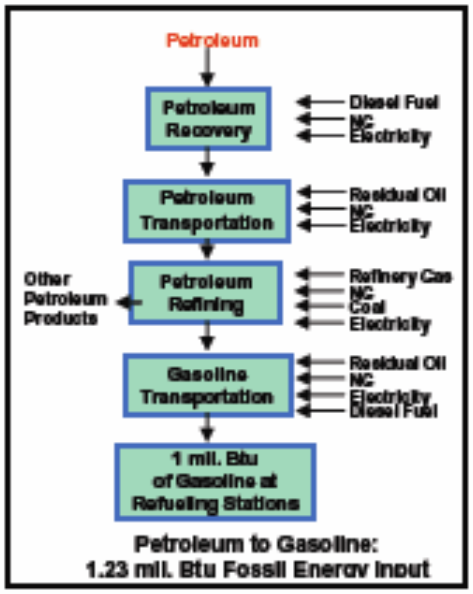
2004 US Energy Consumption



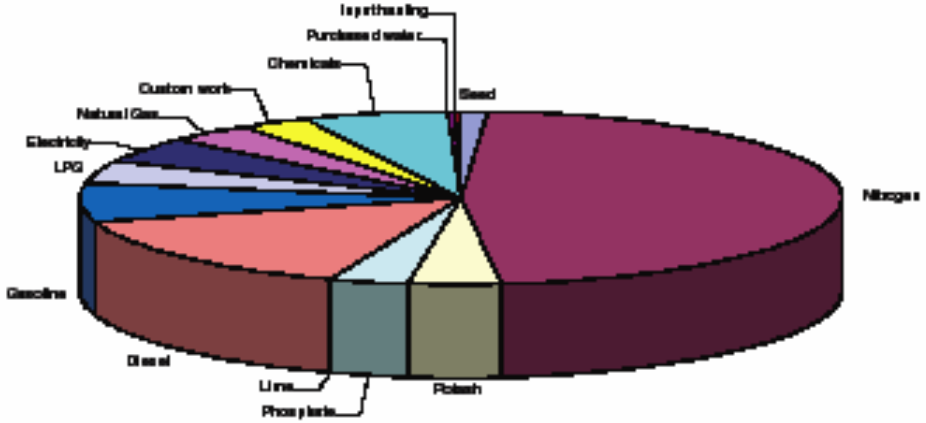
http://www.eia.doe.gov/cneaf/solar.renewables/page/trends/highlight1.htm

Peak Oil





Total Energy Requirement of Farm Inputs, 9-State Weighted Average, Btu per Bushel of Corn, 2001



Potential Alternatives to Oil

- **Finite Sources**

Unconventional Oil

- Ultra Deep Water/Polar
- Tar Sands
- Shale Oil

Coal

Coal-to-Liquids or Natural Gas

Potential Alternatives to Oil

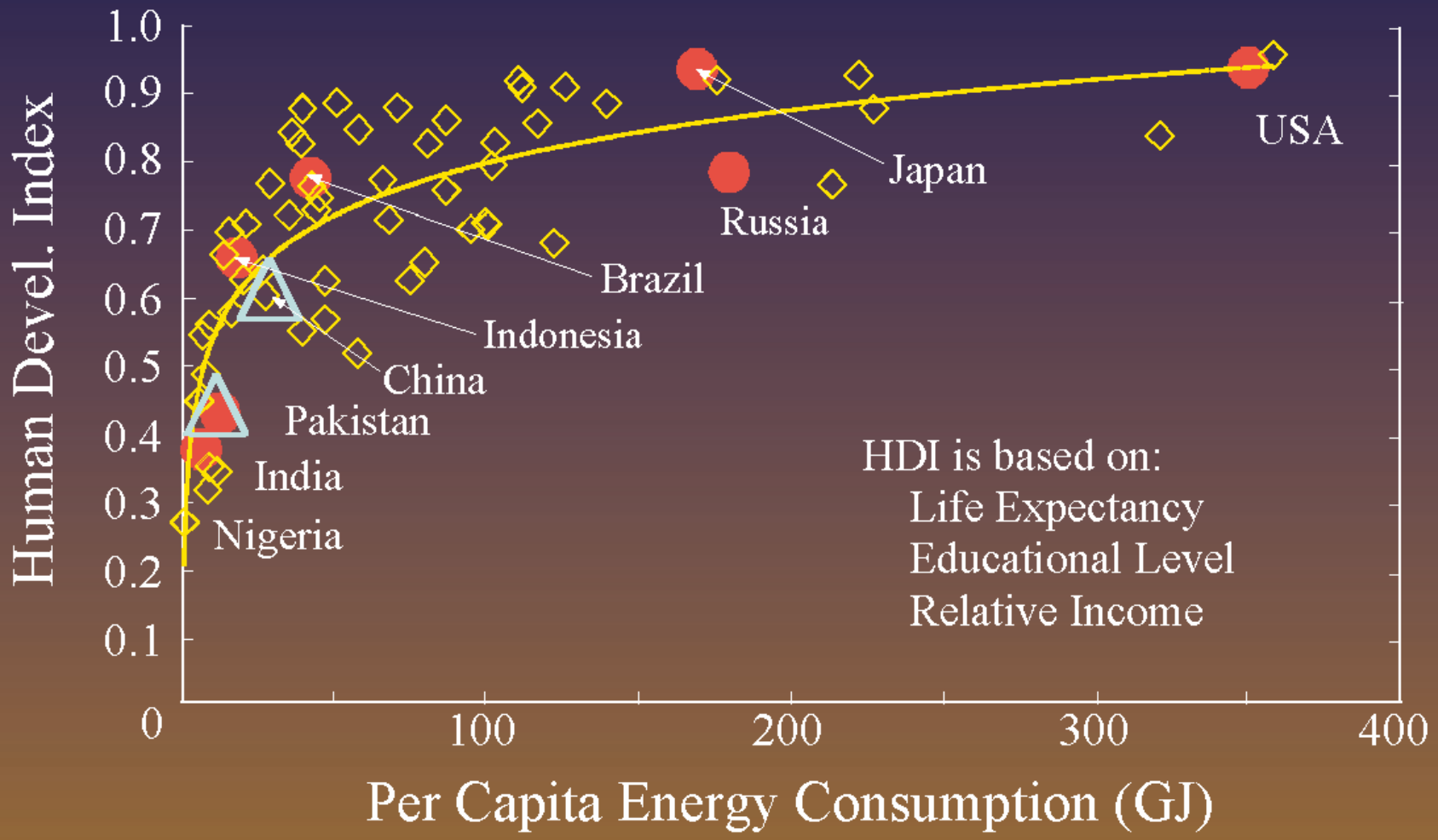
- **Finite Sources**

  Nuclear

  - Fission (light water reactors for electricity and naval propulsion)
  - Breeder reactors
  - Fusion
  - Potential district heating and cooling applications

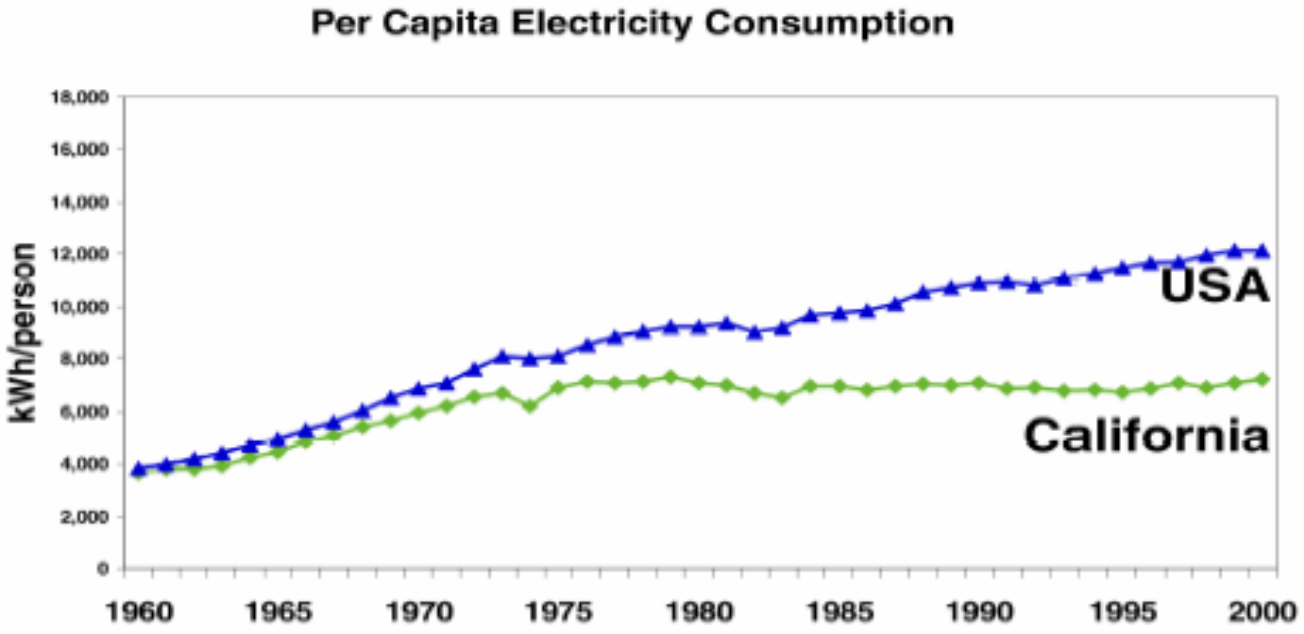
Potential Alternatives to Oil

- **Renewable Resources**
  - Hydroelectric
  - Waste to Energy
  - Solar
  - Wind
  - Geothermal
  - Ocean Energy (tides, OTEC, and currents)
  - Agricultural (biomass/biofuels; food vs. fuel trade-off and sustainability concerns)
  - Hydrogen (from renewables, but *not* an energy source, a "battery" as in fuel cells)
- **Convert Ground Transportation from Liquid Fuels to Electricity**


Human Devel. Index
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
100
200
300
400
Per Capita Energy Consumption (GJ)
USA
Japan
Russia
Brazil
Indonesia
China
Pakistan
India
Nigeria
HDI is based on:
Life Expectancy
Educational Level
Relative Income

Peak Oil

Saving Electricity Slowly



California's per-capita electricity consumption has remained nearly constant for 20 years

INTERNATIONAL ENERGY AGENCY AGENCE INTERNATIONALE DE L'ENERGIE

What America Needs

- The total commitment of **WWII**
- The technology intensity and focus of the **Apollo Program** to land a man on the moon **$275 billion** in 2006 dollars
- The urgency of the **Manhattan Project** to develop the atom bomb **$1.1 trillion** in 2006 dollars
- **Mitigate Peak Oil** **$3-4 trillion over 20 years *BEFORE* peak** in 2006 dollars (DOE #1 and #2)

We are all in the same boat!

For More Information

http://www.bartlett.house.gov/EnergyUpdates